WHAT IS CLAIMED IS:

1. A method of manufacturing a roll adapted for use in manufacturing metal plate, strip, sheet, or foil, comprising the steps of:

providing a cylindrical roll core having a central longitudinal axis;

forming a plurality of longitudinally extending cooling passages in the roll core proximate to the surface of the roll core for conducting a cooling medium through the roll core to cool the roll during use; and

forming at least one metal overlay on the roll core.

2. The method of claim 1 wherein the at least one metal overlay is formed on the roll core by a process selected from the group consisting of: submerged arc welding, spray forming, thermal spraying, hot isostatic pressing, pack diffusion, vapor deposition, and electrolytic plating.

3. The method of claim 1 wherein the cooling passages are formed to be spaced regularly about the central longitudinal axis of the roll core.

4. The method of claim 1 wherein the step of forming the longitudinally extending cooling passages comprises drilling holes in the roll core extending substantially parallel to the central longitudinal axis of the roll core.

5. The method of claim 1 wherein the roll core comprises a roll body, the step of forming the longitudinally extending cooling passages comprises drilling holes in the roll body extending substantially parallel to the central longitudinal axis of the roll core and the entire length of the roll body.

6. The method of claim 5 further comprising the step of attaching end caps to opposite ends of the roll body to close the ends of the cooling passages.

7. The method of claim 1 further comprising the step of heat treating the roll to a temperature of between about 400°F to 1500°F for between about 1 to 48 hours after forming the at least one metal overlay on the roll core.

8. The method of claim 1 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage, the method further comprising forming a plurality of radially extending passages in the roll core to connect the cooling passages to the at least one inlet passage.

9. The method of claim 8 further comprising the step of plugging the radial passages at the surface of the roll core prior to the step of forming the at least one metal overlay on the roll core.

10. The method of claim 8 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

11. The method of claim 8 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

12. The method of claim 1 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage and at least one centrally located and longitudinally extending outlet passage, the method further comprising forming a plurality of radially extending passages in the roll core to connect the cooling passages to the at least one inlet passage and the at least one outlet passage.

13. The method of claim 12 further comprising the step of plugging the radial passages at the surface of the roll core prior to the step of forming the at least one metal overlay on the roll core.

14. The method of claim 12 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

15. The method of claim 12 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

16. A method of manufacturing a roll adapted for use in manufacturing metal plate, strip, sheet, or foil, comprising the steps of:

providing a cylindrical roll core having a central longitudinal axis;

forming a metal overlay on the roll core; and

forming a plurality of longitudinally extending cooling passages in the metal overlay for conducting a cooling medium through the metal overlay to cool the roll during use.

17. The method of claim 16 wherein the metal overlay is formed on the roll core by a process selected from the group consisting of: submerged arc welding, spray forming, thermal spraying, hot isostatic pressing, pack diffusion, vapor deposition, and electrolytic pressing.

18. The method of claim 16 wherein the cooling passages are formed in the metal overlay to be spaced regularly about the central longitudinal axis of the roll core.

19. The method of claim 16 wherein the step of forming the longitudinally extending cooling passages comprises drilling holes in the metal overlay extending substantially parallel to the central longitudinal axis of the roll core.

20. The method of claim 16 wherein the roll core comprises a roll body, the step of forming the longitudinally extending cooling passages comprises drilling holes in the metal overlay extending substantially parallel to the central longitudinal axis of the roll core and the entire length of the roll body.

21. The method of claim 20 further comprising the step of attaching end caps to opposite ends of the roll body to close the ends of the cooling passages.

22. The method of claim 16 further comprising the step of heat treating the roll to a temperature of between about 400°F to 1500°F for between about 1 to 48 hours after forming the metal overlay on the roll core.

23. The method of claim 16 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage, the method further comprising forming a plurality of radially extending passages in the metal overlay and roll core to connect the cooling passages to the at least one inlet passage.

24. The method of claim 23 further comprising the step of plugging the radial passages at the surface of the metal overlay.

25. The method of claim 23 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the metal overlay and roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

26. The method of claim 23 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the metal overlay and roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

27. The method of claim 16 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage and at least one centrally located and longitudinally extending outlet passage, the method further comprising forming a plurality of radially extending passages in the metal overlay and roll core to connect the cooling passages to the at least one inlet passage and the at least one outlet passage.

28. The method of claim 27 further comprising the step of plugging the radial passages at the surface of the metal overlay.

29. The method of claim 27 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the metal overlay and roll core

extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

30. The method of claim 27 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the metal overlay and roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

31. A method of manufacturing a roll adapted for use in manufacturing metal plate, strip, sheet, or foil, comprising the steps of:

providing a cylindrical roll core having a central longitudinal axis;

forming a first metal overlay on the roll core;

forming a plurality of longitudinally extending cooling passages in the first metal overlay for conducting a cooling medium through the metal overlay to cool the roll during use; and

forming at least one additional metal overlay on the first metal overlay.

32. The method of claim 31 wherein the first metal overlay and the at least one additional metal overlay are formed on the roll core by a process selected from the group consisting of: submerged arc welding, spray forming, thermal spraying, hot isostatic pressing, pack diffusion, vapor deposition, and electrolytic plating.

33. The method of claim 31 wherein the cooling passages are formed in the first metal overlay to be spaced regularly about the central longitudinal axis of the roll core.

34. The method of claim 31 wherein the step of forming the longitudinally extending cooling passages comprises drilling holes in the first metal overlay extending substantially parallel to the central longitudinal axis of the roll core.

35. The method of claim 31 wherein the roll core comprises a roll body, the step of forming the longitudinally extending cooling passages comprises drilling holes in the first metal overlay extending substantially parallel to the central longitudinal axis of the roll core and the entire length of the roll body.

36. The method of claim 20 further comprising the step of attaching end caps to opposite ends of the roll body to close the ends of the cooling passages.

37. The method of claim 31 further comprising the step of heat treating the roll to a temperature of between about 400°F to 1500°F for between about 1 to 48 hours after forming the at least one additional metal overlay on the first metal overlay.

38. The method of claim 31 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage, the method further comprising forming a plurality of radially extending passages in the first metal overlay and roll core to connect the cooling passages to the at least one inlet passage.

39. The method of claim 38 further comprising the step of plugging the radial passages at the surface of the first metal overlay prior to the step of forming the at least one additional metal overlay on the first metal overlay.

40. The method of claim 38 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

41. The method of claim 38 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

42. The method of claim 31 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage and at least one centrally located and longitudinally extending outlet passage, the method further comprising forming a plurality of radially extending passages in the first metal overlay and roll core to connect the cooling passages to the at least one inlet passage and the at least one outlet passage.

43. The method of claim 42 further comprising the step of plugging the radial passages at the surface of the first metal overlay prior to the step of forming the at least one additional metal overlay on the first metal overlay.

44. The method of claim 42 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

45. The method of claim 42 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

46. A method of resurfacing an existing roll adapted for use in manufacturing metal plate, strip, sheet, or foil, comprising the steps of:

providing an existing roll having a central longitudinal axis and a roll core comprising a work surface defining grooves or channels;

removing the existing work surface from the roll core to form a substantially smooth surface;

forming a first metal overlay on the substantially smooth surface of the roll core;

forming a plurality of longitudinally extending cooling passages in the first metal overlay; and

forming at least one additional metal overlay on the first metal overlay.

47. The method of claim 46 further comprising the step of connecting the cooling passages to existing cooling conduits in the roll core.

48. The method of claim 46 wherein the first metal overlay and the at least one additional metal overlay are formed on the roll core by a process selected from the group consisting of: submerged arc welding, spray forming, thermal spraying, hot isostatic pressing, pack diffusion, vapor deposition, and electrolytic plating.

49. The method of claim 46 wherein the cooling passages are formed in the first metal overlay to be spaced regularly about the central longitudinal axis of the roll core.

50. The method of claim 46 wherein the step of forming the longitudinally extending cooling passages comprises drilling holes in the first metal overlay extending substantially parallel to the central longitudinal axis of the roll core.

51. The method of claim 46 wherein the roll core comprises a roll body, the step of forming the longitudinally extending cooling passages comprises drilling holes in the first metal overlay extending substantially parallel to the central longitudinal axis of the roll core and the entire length of the roll body.

52. The method of claim 51 further comprising the step of attaching end caps to opposite ends of the roll body to close the ends of the cooling passages.

53. The method of claim 46 further comprising the step of heat treating the roll to a temperature of between about 400°F to 1500°F for between about 1 to 48 hours after forming the at least one additional metal overlay on the first metal overlay.

54. The method of claim 46 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage, the method further comprising forming a plurality of radially extending passages in the first metal overlay and roll core to connect the cooling passages to the at least one inlet passage.

55. The method of claim 54 further comprising the step of plugging the radial passages at the surface of the first metal overlay prior to the step of forming the at least one additional metal overlay on the first metal overlay.

56. The method of claim 54 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

57. The method of claim 54 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage.

58. The method of claim 46 wherein the roll core defines at least one centrally located and longitudinally extending inlet passage and at least one centrally located and longitudinally extending outlet passage, the method further comprising forming a plurality of radially extending passages in the first metal overlay and roll core to connect the cooling passages to the at least one inlet passage and the at least one outlet passage.

59. The method of claim 58 further comprising the step of plugging the radial passages at the surface of the first metal overlay prior to the step of forming the at least one additional metal overlay on the first metal overlay.

60. The method of claim 58 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core extending substantially perpendicular to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.

61. The method of claim 58 wherein the step of forming the radially extending cooling passages in the roll core comprises drilling holes in the first metal overlay and roll core at an acute angle with respect to the central longitudinal axis of the roll core to connect the cooling passages to the at least one inlet passage and at least one outlet passage.